

Block of branching portion of bundle of His from catheter shaft during ablation of left ventricular outflow tract ventricular premature complexes

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ABSTRACT

Ventricular premature contractions are often located in the left ventricular outflow tract (LVOT). Components of the normal atrioventricular conduction apparatus are located just below the aortic valve in proximity to the membranous septum, between the noncoronary cusp and right coronary cusp. We present a case of injury to the bundle of His during an ablation of a ventricular premature contraction in the LVOT below the left coronary cusp, remote from the bundle of His, due to pressure from the proximal shaft of the catheter between the noncoronary cusp and the right coronary cusp.

KEYWORDS Atrioventricular conduction; cardiac conduction system; catheter ablation; His bundle; iatrogenic injury; left bundle branch block; right bundle branch block

The atrioventricular (AV) conduction apparatus is in the proximity of the membranous septum, between the noncoronary cusp and right coronary cusp.¹ We present a case of injury to the branching portion of the bundle of His due to the proximal shaft of an ablation catheter applying pressure between the noncoronary cusp and the right coronary cusp.

CASE REPORT

A 53-year-old man with nonischemic cardiomyopathy was referred for ventricular premature contraction (VPC) ablation due to a 6.5% VPC burden on medical therapy (*Figure 1*). During the procedure, an ablation catheter was placed into the left ventricle via retrograde access through the femoral artery. When mapping the left ventricular outflow tract (LVOT) below the left coronary cusp, alternating right bundle branch block, left bundle branch block (LBBB), and LBBB with junctional beats were seen in addition to the clinical VPCs. Ablation resulted in suppression and subsequent elimination of the VPCs. Contact force ranged from 10 to 20 g. Afterwards, the patient persisted in sinus rhythm with prolonged AV conduction and a LBBB. With atrial

burst pacing, AV block occurred at 729 msec and a split-His was seen, utilizing a 2-5-2 spaced CRD-2 hexapolar catheter. The PR interval was 292 msec and QRS interval was 163 msec. The next day, the patient's PR interval shortened to 206 msec without heart block, although his LBBB persisted (*Figure 1*). He was discharged the following day. On post-procedure day 10, the patient felt excellent without further VPCs, despite a persistent LBBB. On postprocedure day 25, the LBBB resolved with a QRS duration of 110 msec.

DISCUSSION

This patient developed an alternating left and right bundle branch block during mapping just below the left coronary cusp in the LVOT and then developed a persistent LBBB after ablation with a tight J-shaped curve. The proximal shaft of the curve was likely applying pressure and causing mechanical trauma to the branching bundle of His and left bundle branch (*Figure 2*).

The AV node is located within the apex of the triangle of Koch² and transitions into the bundle of His, which can be divided into the penetrating bundle of His and branching bundle of His. The penetrating bundle of His is completely

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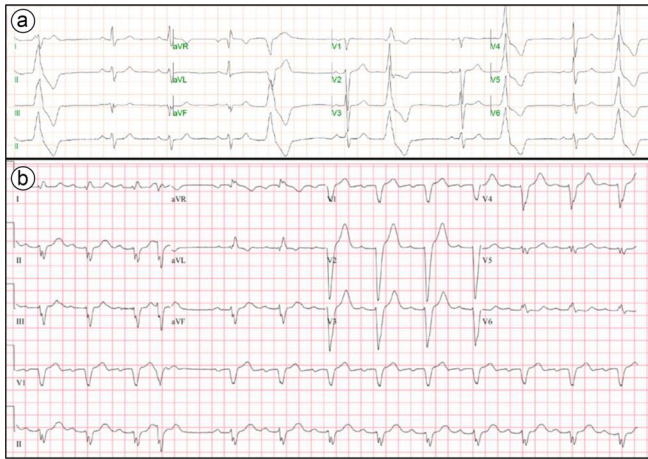


Figure 1. (a) Preprocedure electrocardiogram showing sinus rhythm with occasional inferiorly directed ventricular premature contractions with an atypical right bundle branch block morphology, suggesting a focus from the left ventricular outflow tract. (b) Postprocedure day 1 electrocardiogram showing sinus rhythm with prolonged atrioventricular conduction and left bundle branch block.

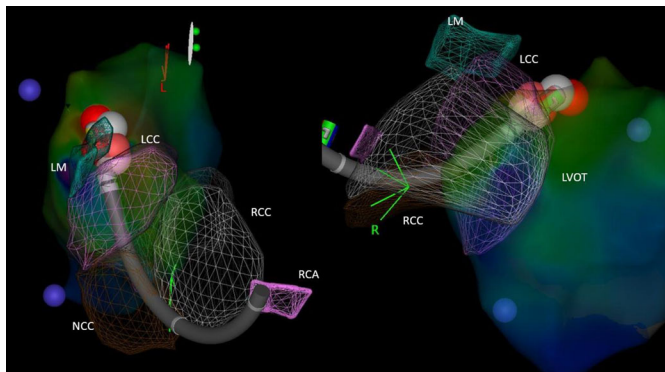


Figure 2. Electroanatomic maps of activation points and ablation with Cartosound contours of coronary cusps and coronary arteries in two projections: cranial view (left) and septal view (right). Purple spheres are mitral annular locations seen on ultrasound. Ablation lesions are in the left ventricular outflow tract below the coronary cusps. The proximal shaft of the catheter can be seen between the right coronary cusp and noncoronary cusp in proximity to the anatomic location of the membranous septum and branching portion of bundle of His. The 81 cm SL-1 sheath was not advanced beyond the aortic root. LCC indicates left coronary cusp; LM, left main artery; LVOT, left ventricular outflow tract; NCC, noncoronary cusp; RCA, right coronary artery; RCC, right coronary cusp.

encased by the central fibrous body, which is within the membranous septum along the apex of the triangle of Koch on the right side and inferior to the noncoronary cusp and right coronary cusp on the left side (Figure 3).³ The branching bundle of His is not protected by the central fibrous body and begins as the bundle of His gives rise to the left bundle branch and terminates at the origin of the right bundle branch. It is in proximity to the aortic ring, below the noncoronary cusp and right coronary cusp along the left ventricular crest.⁴ The left bundle branch runs inferiorly and anteriorly from the branching portion, while the right bundle

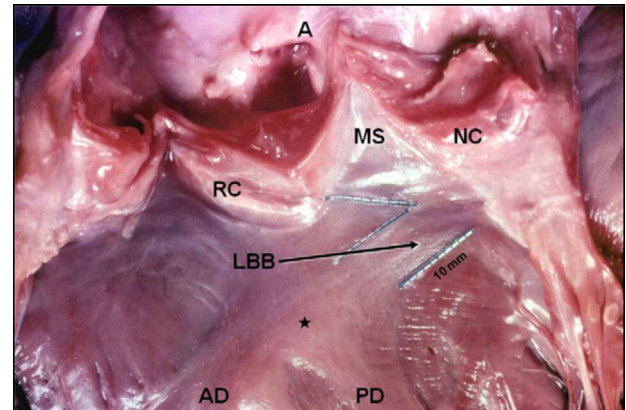


Figure 3. Anatomic view of the left septal surface of the aortic valve and the interventricular septum below the valve. The bundle of His (penetrating and branching portions) is located at the level of the membranous septum. The left bundle branch is clearly seen underlying the endocardium below the membranous septum, which is encompassed between the noncoronary and right coronary aortic cusps at the summit of the ventricular septum. The left bundle branch is oriented inferiorly and anteriorly to the site of its division (asterisk). Its anterior division and posterior division are also identified underneath the endocardium. A indicates aortic valve; AD, anterior division; LBB, left bundle branch; MS, membranous septum; NC, noncoronary cusp; PD, posterior division; RC, right coronary cusp. Reprinted from Elizari, 2017 (1) with permission from Elsevier.

branch emerges on the right side as direct continuation of the bundle of His (Figure 3).¹

While curving the tip of the catheter into the LVOT below the left coronary cusp, the proximal shaft applied pressure along the junction of the noncoronary cusp and right coronary cusp, causing injury to the branching bundle of His, which is not protected by the central fibrous body. This was evidenced by the split His and alternating bundle branch block. Fortunately, complete heart block did not occur and the LBBB resolved in 10 days.

In conclusion, when mapping and ablating within the LVOT, injury to the bundle of His can occur if enough pressure is applied from the proximal shaft of the catheter in a short period of time. If there are any signs of a new bundle branch block or junctional rhythm, the catheter should be repositioned to reduce the risk of persistent injury to the bundle of His.

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